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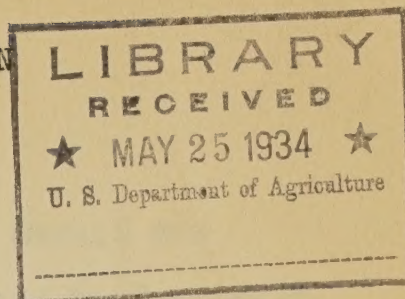
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ANIMAL HUSBANDRY DIVISION  
HAWAII AGRICULTURAL EXPERIMENT STATION  
HONOLULU, HAWAII



Under the joint supervision of the

UNIVERSITY OF HAWAII  
and the  
UNITED STATES DEPARTMENT OF AGRICULTURE

Progress Notes on Experiments and Other Items of Interest

No. 5

March, 1934

These progress notes on experimental work and other items of interest to livestock men in the Territory are issued from time to time by the Animal Husbandry Division. You are invited to suggest other lines of research that you deem important and to submit inquiries to the University.

Introduction

The control of liver fluke is a major economic problem among the dairymen of Hawaii. We are pleased to announce the active cooperation of the Zoology Department of the University in experiments designed to help discover, if possible, ways and means of better controlling the liver fluke in Hawaii.

For those who are not familiar with the liver fluke cycle, the following article by Mr. Riley will be of great interest and value.

L. A. Henke.

THE LIVER FLUKE DISEASE OF CATTLE.

By

Merrill K. Riley, Department of Zoology  
University of Hawaii.

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severe.

It is estimated that 75% of the dairy animals in Hawaii are infected with this disease with a lower percentage among beef animals. Liver fluke disease seems to be distributed all over the island of Oahu, being more severe in some localities than in others. It has also been reported on Maui, Kauai, and Molokai.

#### Nature of the Disease.

"Liver rot" is a disease of the liver caused by a flat, leaf-like worm that lives in the bile ducts of the liver and often causes severe inflammation, lesions or lacerations, swelling of the ducts, puffiness of the liver, and produces poisons that circulate throughout the body of the animal. Often in severe infections these worms may enter other organs of the body such as muscles and especially the lungs.

The worm that produces this disease is about one inch in length and one half inch in width, very thin and leaf-like, and pale-brown in color. The young worms, which are generally found near the surface of the liver, are much smaller and often produce severe lesions on the surface of the liver.

The number of worms present in the liver will vary, depending on the degree of infection or the number of larvae entering the animal. There may be from one to several hundred of these worms present in one animal, and usually only when many worms are present is any serious injury done.

When an animal is slaughtered these worms can be observed by simply making several deep cuts across the central part of the liver. When they are numerous they will "boil" out of the regions where the bile ducts were severed.



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### Symptoms

Fluke infected animals are not always easily recognized, especially when the animal is receiving excellent feed. Usually when the disease first begins the animal appears to gain weight, but this is due to accumulation of water and blood in the body cavity producing a "pot-bellied" condition. Older infection is recognized by loss in weight, and decreased milk production. The coat becomes dull, the skin is tight, and the appetite at intervals is poor. Constipation alternating with diarrhea may occur at various intervals.

A final and definite determination of infection can be made through examination of the feces. These examinations can only be made in the laboratory as the eggs produced by this organism can be seen only with the aid of a microscope.

### How Animals Become Infected.

The adult liver fluke or worm lays thousands of eggs (as many as 30,000 to 100,000) in the bile ducts of the liver. These eggs are extremely small and are visible only through a microscope. They move with the bile in these ducts and finally enter the intestine or digestive tract of the animal by way of the main bile duct. They then pass out of the intestine with the feces or manure. It is thought that one worm may live for about one year, producing eggs most of the time and finally moves out of the liver and dies, passing out of the animal with the manure.

If these eggs in the manure happen to fall into water or are kept wet for about two weeks, they will hatch, liberating a very small larva or miracidium. This organism is able to swim about very actively for about two hours and then perishes unless it happens to find a small fresh water or pond snail. This snail is small (about 3/8 inch in



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If these eggs in the manure happen to fall into water or are kept wet for about two weeks, they will hatch, liberating a very small larva or miracidium. This organism is able to swim about very actively for about two hours and then perishes unless it happens to find a small fresh water pond snail. This snail is small (about 3/8 inch in



length), and very easily broken when picked up. Usually it is confined to streams, especially in quiet pools where cattle are likely to drink, or in ponds that do not dry up readily. Sometimes they are found about watering troughs and tanks, where the ground is moist due to the tanks over-flowing, or in other low places which are moist most of the time.

If this small organism, the miracidium, is fortunate enough to find one of these snails, it burrows into the soft fleshy parts and starts to grow and finally changes into a larger individual which produces many young. Finally, after living about two to three months in this snail, many (may be hundreds) small polly-wog like individuals swim out of the snail moving about actively until they find something onto which they may stick or encyst. These small-tailed organisms or cercaria swim about in the water for as long as one half hour, finally enclosing themselves in a hard wall or cyst. These cysts can be produced right in the water or more likely these cercaria will move about until they strike an object, such as the stem of grass, and then form this cyst. Just how long these cysts may live no one seems to know exactly, but it appears to be several months at least, especially if the cysts are kept moist, and this is quite often the case.

These cysts contain small larvae which are really very small flukes which upon gaining entrance to the digestive tract of the cow will be freed from this cyst and then migrate into the liver, where they grow and in about one to two months begin laying eggs and the cycle starts all over again.

One can see how much danger there might be in using grass for feed that is grown in continually wet places, which are often used for pasturing as well as for cutting and then feeding. Thus, whenever cows containing these worms are allowed to feed in pastures that are more or



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One can see how much danger there might be in using grass for food that is grown in continually wet places, which are often used for pasturing as well as for cutting and then feeding. Thus, whenever cows containing these worms are allowed to feed in pastures that are more or



less wet all the time, the grass in such pastures is likely to cause more liver fluke when fed.

It is also quite possible that the animal could become infected by simply drinking water in which these snails are living. This may be the method by which very heavy infections occur, since twenty to fifty of these small larvae may issue from one snail at one moment. Should the animal be drinking water at this time it may take in many of these larvae at one time. However, it is always necessary that the cyst be already formed or the digestive juices in the stomach of the cow will destroy the delicate cercaria.

If all the eggs (there may be thousands) contained in the feces were to hatch and find a snail in which to develop and if all the cercaria coming from the snail were to survive and find a place to encyst, there would probably be enough of these organisms to infect all the grass in a given pasture. However, fortunately, only very few of the miracidia hatching from these hundreds of eggs survive, and probably many of the cercaria also are lost.

Another helpful factor is that these snails seldom leave the water for a distance greater than a few inches. Also, these cysts when formed will be very close to the surface of the water. Since the cattle eat from the top down they may never reach the infected portion of the grass. Nature has thus provided at least some protection for the cow, and other animals.

The question is often asked, "can one see these cysts on the grass?" If this were possible, cercaria infected grass could be avoided. However, they are hard to see, for that portion of the grass which is likely to be infected is usually muddy, and even if clean, the cysts are so small that they are easily over-looked. These cysts are about the size of a point of a blunt pin and usually yellowish in color. Consequently determination of fluke infested areas require much more study than a simple examination of the grass.



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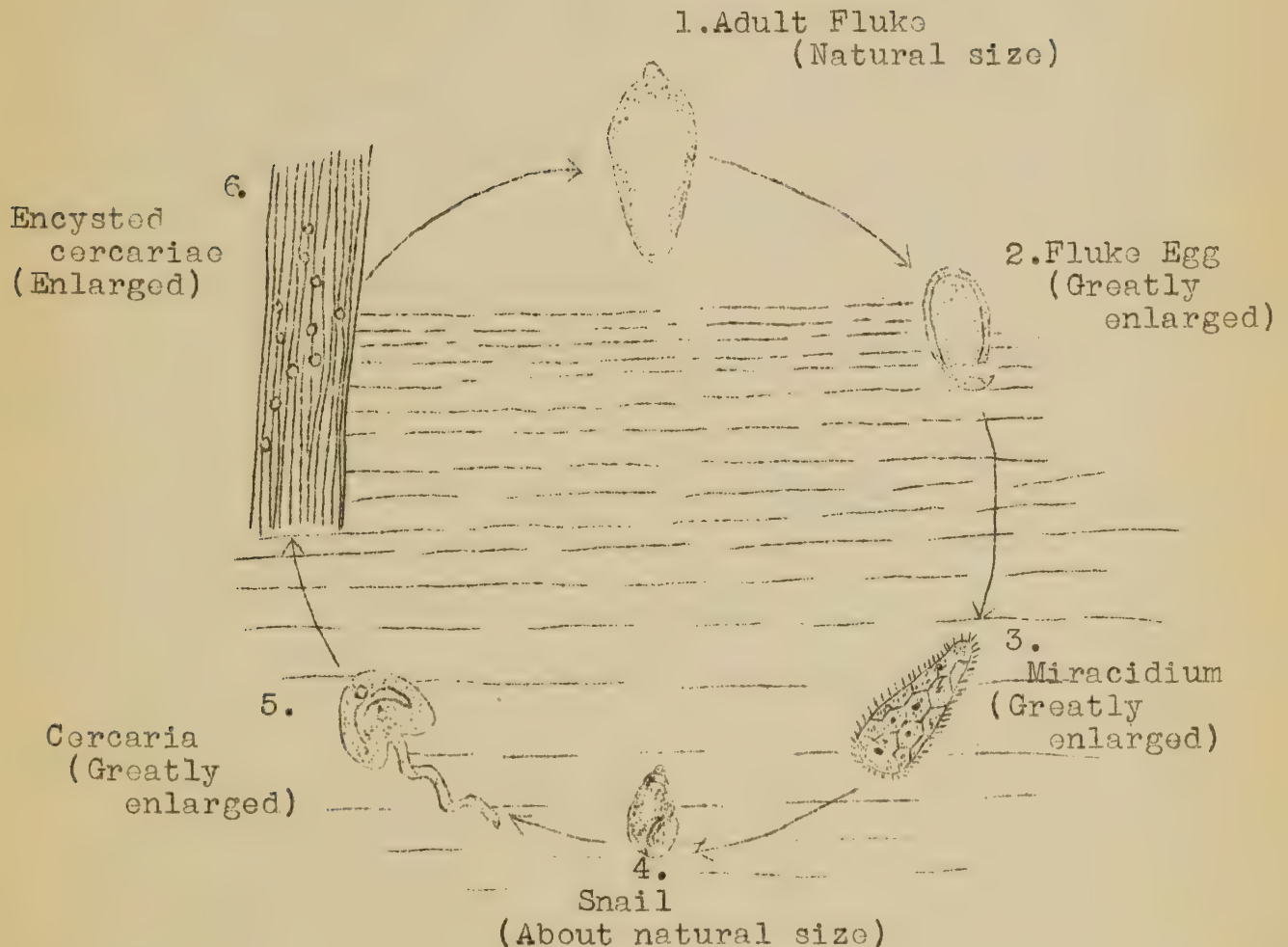
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## LIFE CYCLE OF LIVER FLUKE



The Adult fluke (1) lives in the bile ducts of the liver of cattle. It produces large numbers of small eggs which pass out with the manure. The eggs (2) hatch in water and the free swimming young fluke or miracidium (3) finally enters a suitable snail (4). After a time a young fluke or cercaria (5) escapes from the snail and encysts on the water or vegetation (6). The encysted cercaria is swallowed by the cow, gets into the liver and becomes a mature fluke, and starts the life cycle all over again. (After Jay).



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### Determination of Fluke Infested Areas.

It is not always easy to tell if cows are infested with flukes. However, if one can find the proper snail in wet areas such as a stream in the vicinity where cattle are feeding or have recently fed (from one to several months), examination might reveal fluke infested snails. By placing these snails in the palm of the hand with a drop of water and crushing them carefully small whitish bodies may appear in the water. These may be as long as one sixteenth of an inch. Generally they will be of all sizes. After one has once definitely recognized these larvae he can become very efficient in locating fluke infested areas.

### Problems and Control Measures.

It is not the purpose of this explanation to outline a definite control measure, but merely to make a few suggestions to show what might be done if the dairyman or the cattleman becomes sufficiently interested.

1. It is very certain that one can not "clean up" his herd in a very short period of time. We do not as yet have definite information on how long the fluke lives in the liver, but probably about one year. Since reinfection may occur any time it is difficult to determine this except under carefully controlled conditions. Thus as long as snails are present there will be danger of continued infection.

2. If all the snails in the vicinity of the pasture were killed danger of reinfection would be greatly lessened, though for an indefinite length of time the grass may be infective because of cercaria already encysted on the grass. Unfortunately we do not as yet have definite information on how long these cysts may live on the grass, and hence we do not know how soon grass can be used after snails have been killed. The practice of cutting grass any and everywhere is



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very dangerous and doubtlessly many of our present fluke problems result from this practice.

3. If infected cattle were removed from wet areas the cattle would free themselves of the worms in probably a year, and at the same time avoid reinfesting the wet area, so that in time it, too, would become fluke-free, and healthy animals could be placed in the pasture without endangering them even though snails were still present. Such a procedure would require careful study in order to determine when the snails were free of fluke larvae, and when the grass would be safe to use. On the latter point we particularly need more information.

4. If all the snails in the danger area could be killed, and kept out, in a short time, possibly one year, all cattle, both healthy and infected, could be pastured without any danger of reinfection. The destruction of snails is probably the most important phase of the program, especially when it can be done thoroughly. Copper Sulphate (Blue Stone) (Blue Vitrol) is very fatal to snails even when used in very small quantities. This substance is used at the rate of 1 part to 500,000 of water. To determine the exact quantity for a stream or pond is very difficult and generally requires several attempts. Copper sulphate is fatal to fish, so its use requires great care. It is best to consult someone familiar with these treatments before attempting it. This concentration is not injurious to cattle.

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5. Treatment of the infected animal to kill the flukes is not to be recommended. The use of carbon tetra-chloride has been quite successful in treating sheep, but fatalities are very frequent when administered to cattle.

Summary.

1. Probably about 75% of our dairy cows are infected with liver flukes. Many of our beef cattle are likewise infected, but not to as great an extent.

2. The beef cattle areas on the island of Hawaii seemingly are entirely free or only slightly infected with liver fluke.

3. Liver fluke disease or "liver rot" is caused by flat, brown, leaf-shaped worms living in the bile ducts of the livers of cattle, sheep and goats.

4. Each fluke may produce from 30,000 to 100,000 eggs which pass out of the animal in the feces.

5. When the eggs hatch, the embryo or larva, moves about in the water in search of a water snail for an intermediate host. If no host is found the embryo lives only a few hours and then perishes.

6. Embryos which find a snail develop and in two to three months encyst on vegetation or on the surface of the water. These cysts infect, cattle, sheep, and goats. The exact length of life of these cysts is not definitely known, but probably at least one year.

7. Inside the digestive tract of these animals the cyst wall dissolves away and the young flukes may move up the bile duct to the liver or bore through the intestinal wall and then to the liver where they grow to maturity and start laying eggs, completing the life cycle.

8. Liver fluke in cattle causes unthriftiness of infected animals, decreased milk production, wastage of feed in finishing them for



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3. Liver fluke disease or "liver rot" is caused by flat, brown, leaf-shaped worms living in the bile ducts of the livers of cattle, sheep and goats.
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market, reduced value of livers (condemned by inspectors) and loss of rentals from range lands where flukes are known to be prevalent.

9. Infected animals do not always show external symptoms, but usually there is "pot-bellied" appearance when the infection is starting, and wasting away in later stages, the coat is dull and staring, the skin is tight, the appetite is poor at times, and constipation alternates with diarrhea.

10. No treatment for flukes in cattle is recommended. The destruction of snails by placing proper quantities of copper sulphate in streams, ponds, pastures, and watering troughs is the best preventive. Application should be made before snails have become infected with the miracidium of the liver fluke. Copper sulphate in dilutions necessary to kill snails is not injurious to grasses, or livestock, but is fatal to fish.

11. One fluke infested area or herd may be the source of infection for other areas and herds.

12. Many important aspects of the problem are not definitely understood, but research is in progress with the hope of learning how to better control the liver fluke problem in Hawaii.

13. A vulnerable point in the liver fluke cycle is the snail. If snails are completely destroyed, liver fluke will soon eliminate itself.



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